Sydney, 0.12; Chatham, 0.10. The deficits were: Omaha, 0.09; Miles City, Huron, Moorhead, St. Paul, Marquette, Davenport, 0.08. In Canada, Winnipeg, 0.09; Calgary, 0.07; Swift Current, 0.06; Qu'Appelle, White River, and Port Stanley, 0.05.

As compared with the preceding month of June, the pressures reduced to sea level show a decided rise in New England and the Canadian Provinces, Washington, Oregon, and in the Rocky Mountain Plateau Region, and on the eastern Slope. Elsewhere a slight fall is reported. The greatest rises were: Tatoosh Island, Fort Canby, El Paso, and Eastport, 0.11; Seattle, Portland, Oreg., Santa Fe, 0.09; Omaha, Nantucket, 0.07. In Canada, St. Johns, N. F., Halifax, Yarmouth, 0.14; Charlottetown, 0.13; Sydney, 0.12; Chatham and Father Point, 0.10. The greatest falls were: In the United States, Duluth, Marquette, Port Huron, Detroit, Sandusky, Cleveland, and Erie, 0.05. In Canada, Prince Albert, 0.08; Battleford, Winnipeg, Port Arthur, White River, Port Stanley, 0.05.

AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During the month there were but four highs sufficiently well defined to be charted, and eight lows. The tracks of these conditions will be found on Charts I and II. The accompanying table gives the principal facts regarding the origin and disappearance and apparent motion or translation of these conditions. As usual, during the summer season, both highs and lows have been ill defined and could be followed only with difficulty. As already noted in May and June, the highs appeared to be offshoots from the permanent high pressure in the Pacific. There was also a slight indication of a translation along the Pacific Coast from south to north before the advance into the country. The paths of all of the highs crossed the country from the north Pacific to the south Atlantic Coast. The general course of the lows was to the north of Montana, and nearly every track was along the north border of the country. Numbers II, V, VII, and VIII of the lows reached the north Atlantic Coast, but the other four vanished to the west of the Mississippi River and Great Lakes.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	7, p. m.	47	128	12, a. m.	35	102	1,980	4.5	428	17.8
II	10, a. m.	53	109	14, a. m.	31	89	1,910	3.5	545	22.7
III	16, p. m.	46	128	23, p. m.	26	80	3,510	7.0	501	20.8
IV	24, p. m.	45	126	31, p. m.	31	78	3,520	7.0	503	21.0
Total							10,870	22.0	1,997	
Mean of 4 paths							2,717		494	20.6
Mean of 22.0 days									494	20.6
Low areas.										
I	1, a. m.	52	115	5, a. m.	51	94	1,420	4.0	355	14.8
II	5, p. m.	54	113	14, p. m.	49	68	4,540	9.0	504	20.9
III	12, a. m.	54	116	16, a. m.	40	88	2,410	4.0	602	25.1
IV	14, p. m.	51	116	18, a. m.	52	100	1,430	3.5	409	17.0
V	19, p. m.	50	114	25, a. m.	44	64	2,540	5.5	463	19.3
VI	21, a. m.	53	115	24, a. m.	41	96	1,260	3.0	420	17.5
VII	24, p. m.	53	103	30, p. m.	44	62	3,010	6.0	501	20.8
VIII	27, p. m.	52	111	*	43	63	2,680	5.5	488	20.3
Total							19,290	40.5	3,742	
Mean of 8 paths							2,411		468	19.5
Mean of 40.5 days									476	19.8

* August 2, a. m.

LOCAL STORMS.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

3d, 6th, 8th.—Unusually heavy rainfall, accompanied by winds of sufficient force in some cases to unroof buildings and prostrate frail structures, prevailed over portions of Minnesota and northern Wisconsin. It is estimated that the streets, parks, etc., in the city of Duluth were damaged by the rain and wind of the 3d to the extent of $50,000.

On the 6th a tornado formed a short distance west of Lowery, Pope County, Minn. It traveled about 6 miles in a northeasterly direction in a path from 25 to 80 rods in width. Two persons were killed and 8 injured. Its approach was very generally observed and almost everyone had an opportunity to escape.

12th, 13th, 14th.—Many severe thunderstorms occurred on these dates throughout Michigan, Ohio, and eastward to the Atlantic. The winds on the coast from New Jersey to Maine were unusually severe for the season. Three lives were lost by drowning, and several small craft were wrecked.

22d.—A very severe thunderstorm and squall wind swept over Philadelphia and vicinity. Damages by hail, wind, and water were sustained in all parts of the city.

23d.—A violent thunderstorm experienced in New York on the afternoon of this date. Lightning struck in many places, including several of the high structures in the neighborhood of the City Hall. Beyond shattering the flagstaffs, but little damage was done.

30th.—A minor tornado was observed at 7 p. m., central time, near the town of San Jose, Ill. One house was destroyed and 6 of the inmates killed. Five other persons were injured. The path of the storm was quite narrow; its length could not be ascertained.

TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

The mean temperatures and the departures from the normal, as determined from records of the maximum and minimum thermometers, are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II. The mean temperatures given in Table III for Canadian stations are the simple means of 8 a. m. and 8 p. m. simultaneous observations.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean* temperature of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *highest mean temperatures* were: In the United States, Yuma, 91.1; Phœnix, 89.6; San Antonio, 85.0; Shreveport, 84.8; Palestine, 84.4; Galveston and Port Eads, 84.2. In Canada, Bermuda, 78.4; Toronto and Ottawa, 71.2; Parry Sound, Montreal, 70.6; Kingston, 70.2; Port Stanley, 70.1. The *lowest* were: In the United States, Point Reyes Light,

54.4; Tatoosh Island, 55.0; Port Angeles, 55.1; Eureka, 55.8; Fort Canby, 57.8. In Canada, Banff, 52.6; Esquimault, 56.5; St. Johns, N. F., 56.8; Calgary, 57.5; Father Point, 57.7; Edmonton, 58.1.

As compared with the normal for July, the mean temperature for the current month was in excess slightly on the California coast, but decidedly throughout the Mississippi watershed, Lake Region, northern New England, and the Maritime Provinces. It was decidedly deficient over the Rocky Mountain Plateau Region and slightly on the New England Coast. It was the coldest on record for the eastern portions of Washington and Oregon.

The greatest excesses were: In the United States, Sault Ste. Marie, 5.5; Buffalo, 4.7; Northfield, 4.5; Milwaukee, 3.8; Alpena, 3.7; Green Bay, 3.5; Topeka, 3.4. In Canada, White River, 6.5; Parry Sound, 5.6; Saugeen, 5.4; Rockliffe, 4.6. The deficits were: In the United States, Walla Walla, 4.6; Baker City, 4.4; Lander, 4.3; El Paso, 3.7; Salt Lake City, 3.6. In Canada, St. Johns, N. F., 4.2; Esquimault, 3.5; Battleford, 2.9; Edmonton and Medicine Hat, 2.8.

Considered by districts the mean temperatures of the current month show departures from the normal as given in Table I. The greatest positive departures were: Lower Lake, 2.2; Upper Lake, 3.0; Missouri Valley, 1.5. The greatest negative departures were: Southern Plateau, 2.4; Northern Plateau, 3.6.

In Canada, Prof. R. F. Stupart says:

> Temperature was a little below average in British Columbia and the Northwest Territories; it was from 0° to 4° above in Manitoba, and from 3° to 7° above in the Province of Ontario. In Quebec, between Montreal and Quebec City, it was 4° above, and thence the difference diminished to about 1° above at Gaspe. In New Brunswick and Nova Scotia there was a general excess ranging between 1° and 3°.

The *years of highest and lowest mean temperatures* for July are shown in Table I of the REVIEW for July, 1894. The mean temperature for the current month was the highest on record at: Palestine, 84.4; Parkersburg, 76.5; Milwaukee, 73.2; Alpena, 69.0; Sault Ste. Marie, 67.6. It was the lowest on record at: Baker City, 62.2; Spokane, 65.2; Winnemucca, 68.1; Walla Walla, 70.6; Salt Lake City, 71.9.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 112, Yuma (10th); 110, Fresno (11th); 107, Phœnix (30th); 106, Red Bluff (13th); 105, Walla Walla and Sacramento (11th), Abilene (26th). The lowest maxima were: 62, Tatoosh Island (13th); 67, Eureka (18th), Port Angeles (9th); 69, Fort Canby (13th); 74, Astoria (10th), 78, Block Island and Woods Hole (16th). The highest minima were: 74, Port Eads (frequently); 72, Corpus Christi (14th); 71, New Orleans (17th), Charleston (14th); 70, Key West (7th), Tampa (17th), Galveston (27th). The lowest minima were: 34, Idaho Falls (19th); 35, Winnemucca (8th); 37, Baker City (7th); 39, Carson City (8th); 40, Cheyenne (frequently); 41, Lander 18th.

The *years of highest maximum and lowest minimum temperatures* for July are given in the last four columns of Table I of the REVIEW for July, 1896. During the current month the maximum temperatures were equal to or above the highest on record at: Kansas City, 102; Sandusky, 100; Rochester and Parkersburg, 99; Alpena, 98; Cleveland, 97; Northfield and Buffalo, 95; Erie, 94; Grand Haven, 93. The minimum temperatures were equal to or below the lowest on record at: Winnemucca, 35; Santa Fe and Pueblo, 43; San Francisco, 47; Abilene, 61.

The *greatest daily range of temperature and the data for computing the extreme and mean monthly ranges* are given for each of the regular Weather Bureau stations in Table I. The largest values of the greatest daily ranges were: Fresno, 52; Idaho Falls, 50; Havre and Pueblo, 45; Cheyenne, 44; Walla Walla, Winnemucca, and Carson City, 43. The smallest values were: Tatoosh Island and Hatteras, 11; Key West, 13; Port Eads, San Diego, and Fort Canby, 15; Nantucket, 16.

Among the *extreme monthly ranges* the largest were: Idaho Falls, 62; Winnemucca, 61; Pueblo and Fresno, 58; Baker City, 56; Walla Walla and Miles City, 55. The smallest values were: Tatoosh Island, 14; Port Eads, 19; Fort Canby, San Diego, and Hatteras, 20; Key West and Eureka, 21.

Accumulated monthly departures from normal temperatures from January 1 to the end of the current month are given in the second column of the following table, and the average departures are given in the third column, for comparison with the departures of current conditions of vegetation from the normal condition.

Districts.	Accumulated departures.		Districts.	Accumulated departures.	
	Total.	Average.		Total.	Average.
	°	°		°	°
New England	+ 3.7	+ 0.5	Ohio Valley and Tenn.	— 1.1	— 0.2
Middle Atlantic	+ 0.7	+ 0.1	North Dakota	— 5.0	— 0.7
South Atlantic	+ 0.7	+ 0.1	Northern Slope	— 2.1	— 0.3
Florida Peninsula	+ 0.1	+ 0.0	Southern Slope	— 0.2	— 0.0
East Gulf	+ 1.9	+ 0.3	Southern Plateau	— 6.1	— 0.9
West Gulf	+ 6.2	+ 0.9	Middle Plateau	— 8.0	— 1.1
Lower Lake	+ 3.6	+ 0.5	North Pacific	— 1.2	— 0.2
Upper Lake	+ 9.2	+ 1.3	Middle Pacific	— 1.6	— 0.2
Upper Mississippi Valley	+ 2.6	+ 0.4	South Pacific	— 4.1	— 0.6
Missouri Valley	+ 2.1	+ 0.3			
Middle Slope	+ 2.9	+ 0.4			
Northern Plateau	+ 5.4	+ 0.8			

MOISTURE.

The *quantity of moisture* in the atmosphere at any time may be expressed by the weight of the vapor coexisting with the air contained in a cubic foot of space, or by the tension or pressure of the vapor, or by the temperature of the dew-point. The mean dew-point for each station of the Weather Bureau, as deduced from observations made at 8 a. m. and 8 p. m., daily, is given in Table I.

The *rate of evaporation* from a special surface of water on muslin at any moment determines the temperature of the wet-bulb thermometer. The mean wet-bulb temperature is now published in Table I; it is always intermediate, and generally about half way between the temperature of the air and of the dew-point. The quantity of water evaporated in a unit of time from the muslin surface may be considered as depending essentially upon the wet-bulb temperature, the dew-point, and the wind.

The *relative humidity*, or the ratio between the moisture that is present in the air and the moisture that it would contain if saturated at its observed temperature is given in Table I as deduced from the 8 a. m. and 8 p. m. observations. The general average for a whole day, or any other interval, would properly be obtained from the data given by an evaporometer, but may also be obtained, approximately, from frequent observations of the relative humidity.

PRECIPITATION.

[In inches and hundredths.]

The *distribution of precipitation* for the current month, as determined by reports from about 2,500 stations, is exhibited on Chart III. The numerical details are given in Tables I, II, and III. The total precipitation for the current month was largest, exceeding 19 inches in central and western Connecticut, and exceeding 6 inches over the greater part of New England and the Middle Atlantic coast region. It was also unusually large in Wisconsin and the Florida Peninsula. Little or no rain fell in Oregon, California, southern Idaho, Nevada, Utah, parts of Arizona and New Mexico.